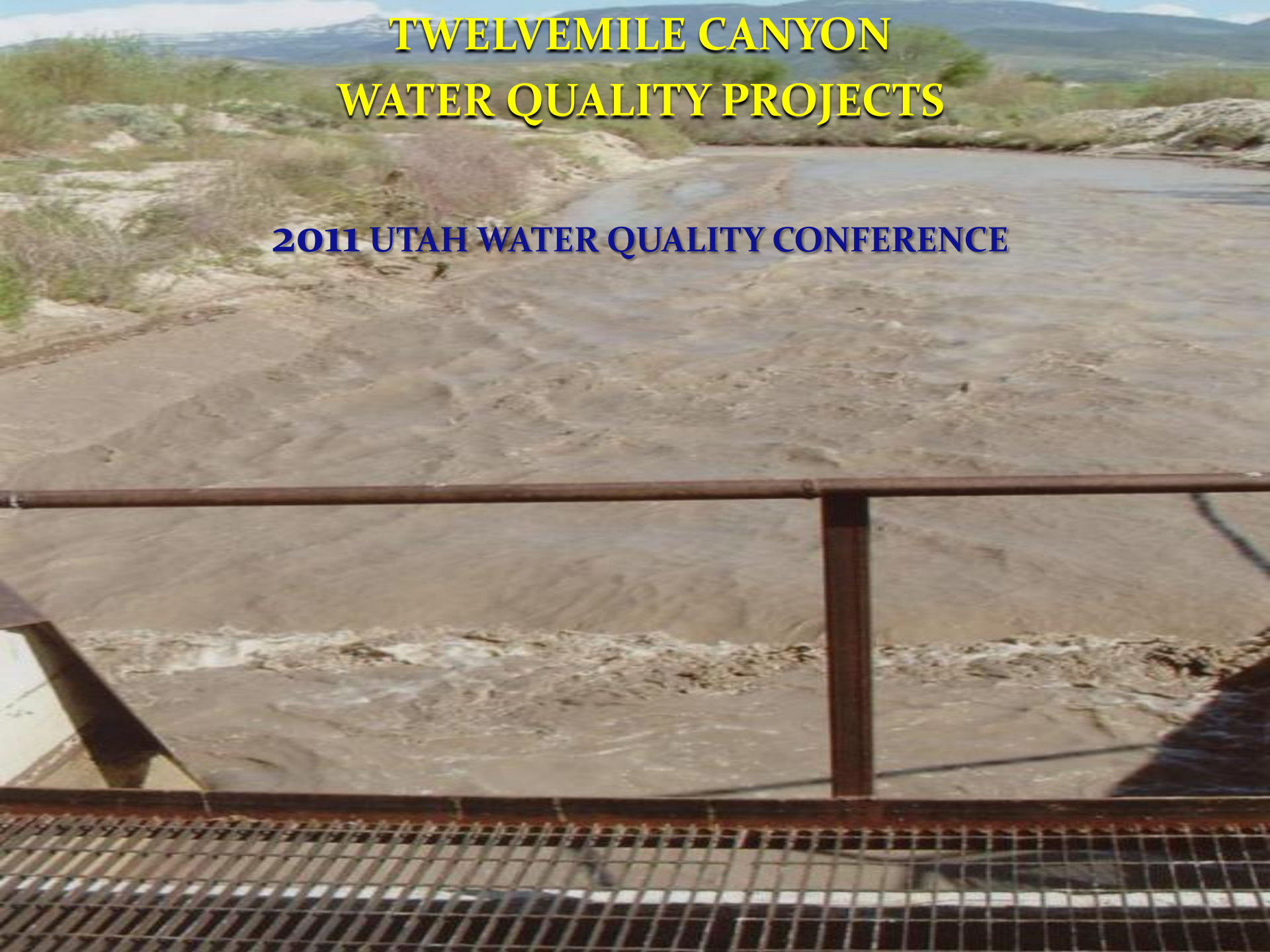
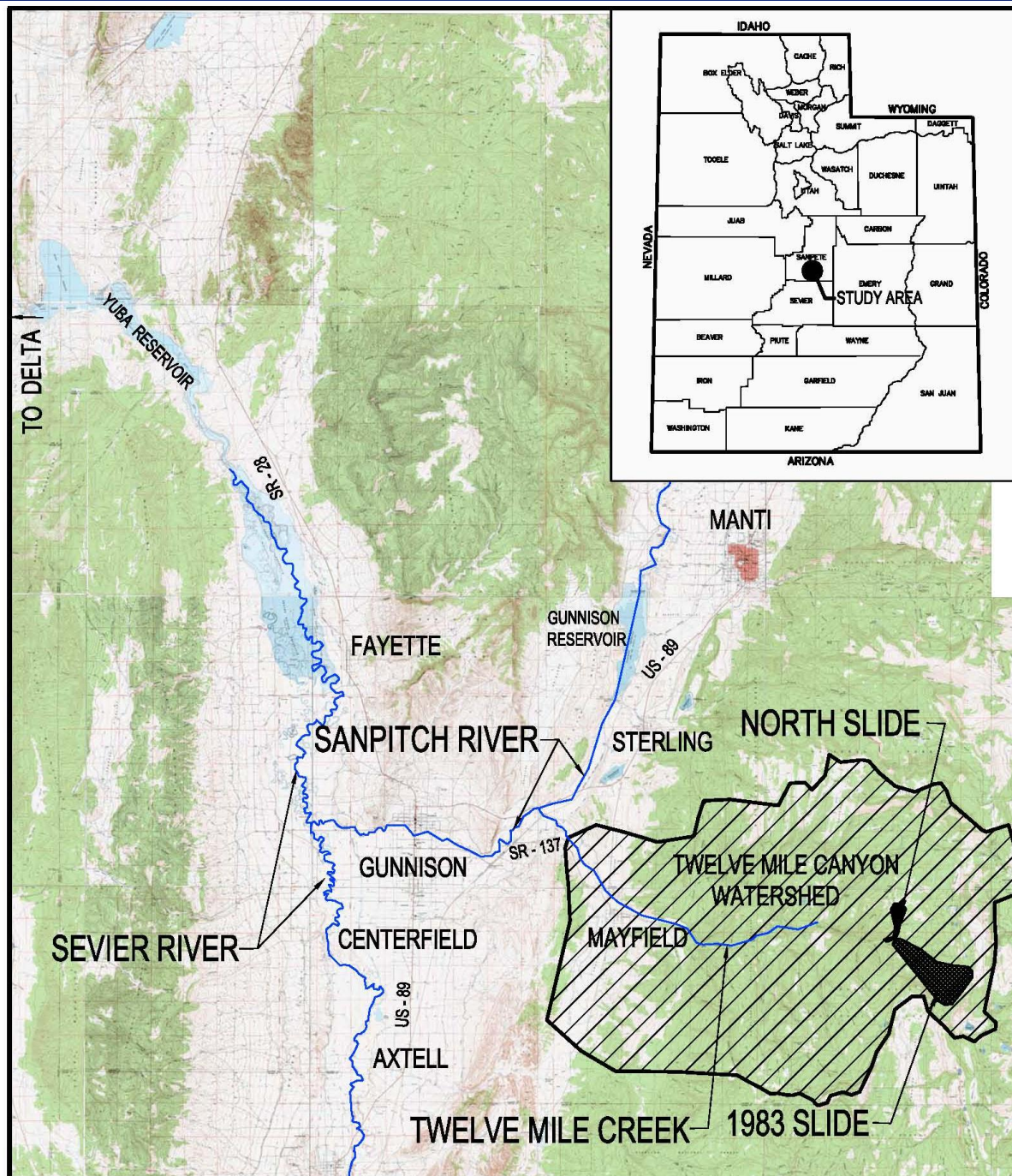


# TWELVEMILE CANYON WATER QUALITY PROJECTS

**2011 UTAH WATER QUALITY CONFERENCE**







# PURPOSE & NEED

- Twelvemile Creek is classified for uses as:
  - Class 2B - Secondary Contact Recreation
  - Class 3A – Cold Water Species of Game Fish & Other Species
  - Class 4 – Agricultural Uses (irrigation & stock watering)
- Suspended sediment concentrations
  - Impedes cold water species in Twelvemile Creek
  - Negatively impacts all Twelvemile Creek water users (ranchers, farmers, community residents)
    - Maintenance costs – cleaning ponds, canals, filters
    - Irrigation system wear
    - Local communities – higher demand on culinary system
      - Mayfield Town – 6% of Mayfield Irrigation Co. water shares
      - Gunnison & Centerfield – 6% of Gunnison Irrigation Company water shares
    - Reduces nutritional value of crops (Relative Feed Value) which reduces sales price of crop.





1983  
SLIDE

This is an aerial photograph of a mountainous region. A large, irregularly shaped area on the left side of the image is outlined with a thick black line, indicating a landslide. The area within the outline is characterized by light-colored, exposed earth and rock, contrasting with the surrounding green forest. A small orange dot is located within this outlined area. The text '1983 SLIDE' is written in bold yellow capital letters to the right of the outlined area. The background shows rolling hills and valleys covered in dense forest, with some areas of exposed rock or cleared land visible.



# TWELVEMILE CANYON -LANDSLIDE ACTIVITY

- 1983
  - Highest precipitation totals on record
  - Several large slides activated
    - South Fork Slide (One of the largest landslides in North America)
    - Presently, majority of the 1983 South Fork Slide appears inactive
- 1998 - Cooley Creek Slide activated
- 1999 - Forest Service reseeded disturbed material generated from Cooley Creek Slide
- 2003 - Seeded areas well established
- 2004
  - Cooley Creek Slide reactivated
  - Eliminated all but a few small patches of established seeded area
- 2006 - Cooley Creek Slide reactivated





↑ NORTH

TWELVEMILE CREEK  
(ABOVE THE OLD FORKS)

OLD FORKS

COOLEY CREEK SLIDE

SOUTH FORK CREEK

KNOLL

1 MILE

1983 SLIDE

ACTIVE AREA ON  
1983 SLIDE



**SPRING  
2007**





**SPRING  
2007**





**SPRING  
2007**





**SPRING  
2007**





**SPRING  
2007**





**SPRING  
2007**







**SPRING  
2007**



**SPRING  
2007**





**SPRING  
2007**





**SPRING  
2007**





A landscape photograph showing a large debris field of logs and mud in a valley. The foreground and middle ground are dominated by a wide, muddy path or debris field covered with numerous logs and branches. The background features steep, forested mountains with patches of snow on their upper slopes and peaks. The sky is clear and blue. The text "SPRING 2007" is overlaid in yellow on the right side of the image.

**SPRING  
2007**



**SPRING  
2007**





**SPRING  
2007**





**SPRING  
2007**





**SPRING  
2007**





**2004**





2011





2011





2011





2011



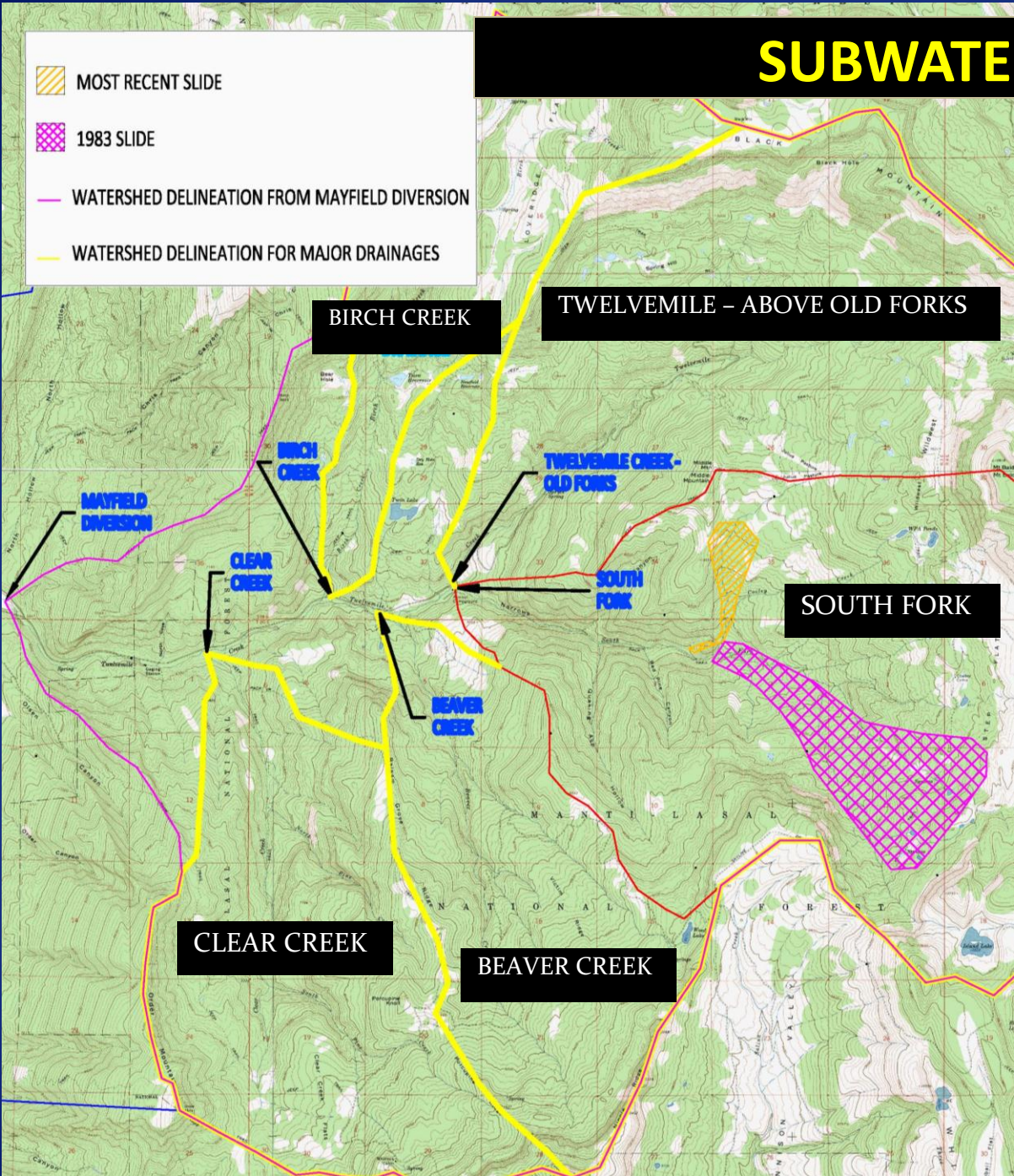


2011



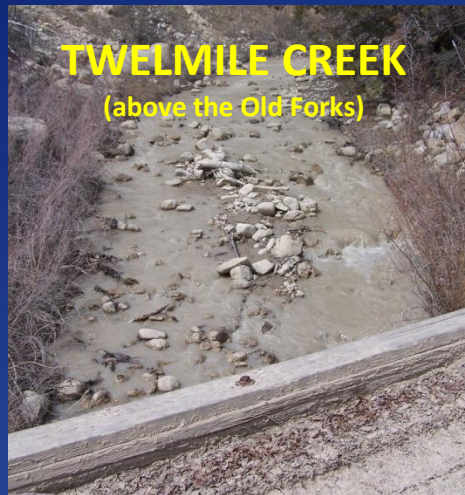


## SUBWATERSHEDS

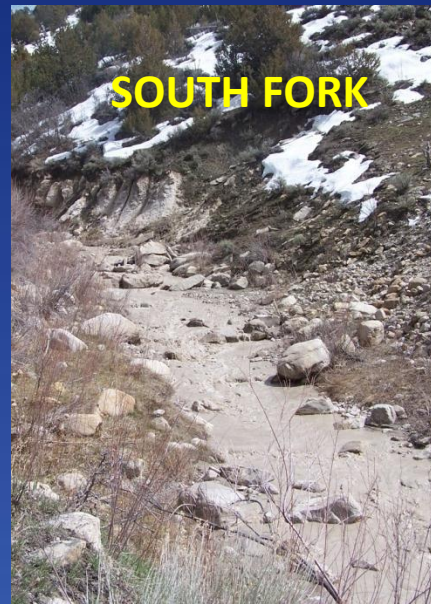




APRIL 18, 2008



**TWELMILE CREEK**  
(above the Old Forks)



**SOUTH FORK**



**BEAVER CREEK**



**BIRCH CREEK**



**CLEAR CREEK**



**MAYFIELD DIVERSION**



## TWELVEMILE CREEK (ABOVE THE OLD FORKS)



## SOUTH FORK



SUMMER 2008













2005



2005





2005







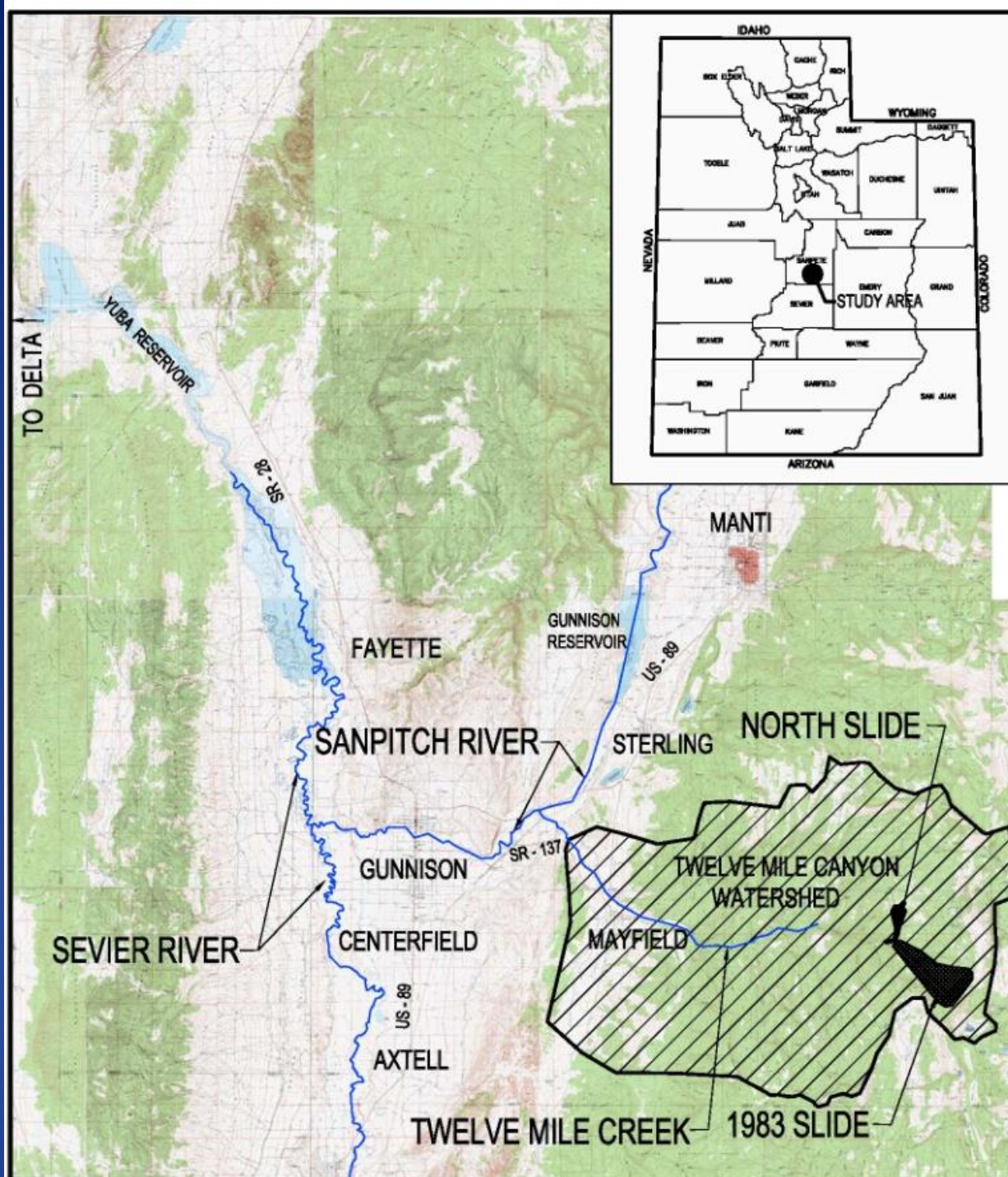
2005





2005







# PURSUIT OF SOLUTIONS

## **PHASE I** – Water Quality Study (COMPLETED)

1. Project Partner Development
2. Mapping & Data Gathering
3. Economic Impact Analysis

**FUNDING :** \$150,000 Grant: Utah Division of Water Quality

## **PHASE II** – Data Evaluation and Alternatives Analysis (COMPLETED)

**FUNDING :** \$150,000 Grant: 2008 Utah State Legislature

\$150,000 Grant: Utah Community Impact Board

## **PHASE III** – Final Design and Construction (IN PROGRESS)

**FUNDING :** \$727,400 Grant: Utah Water Quality Board

\$68,000 Grant: San Pitch Watershed Stewardship Group

Gunnison Irrigation Company

Mayfield Irrigation Company

2012 Resource Advisory Council?



# PHASE I

## TASK 1. PROJECT PARTNER DEVELOPMENT

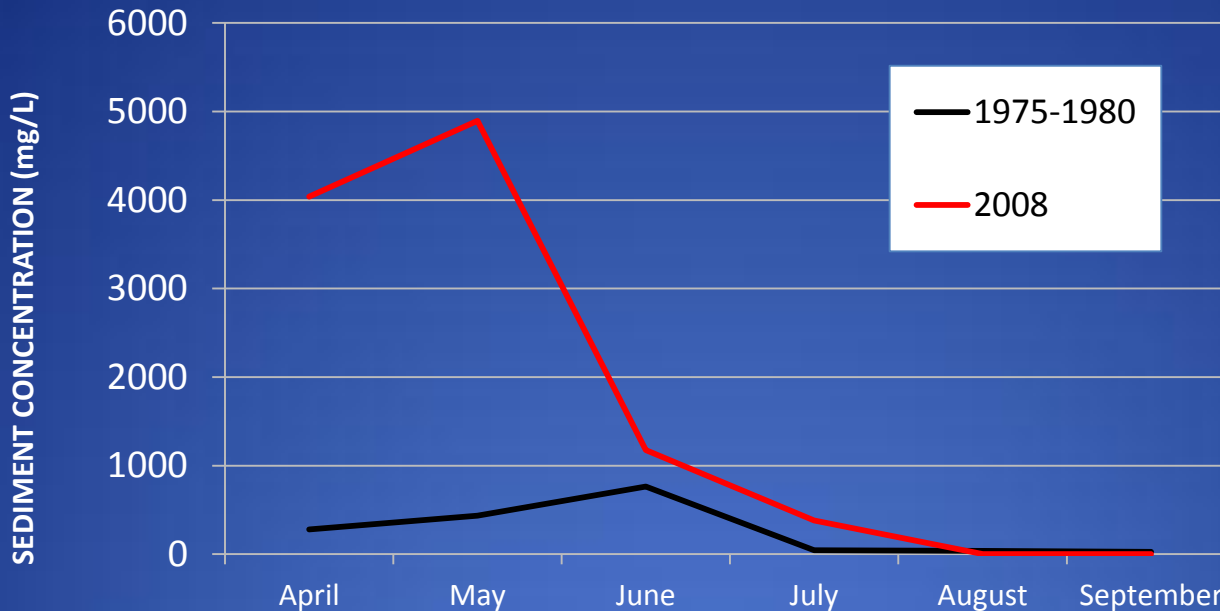
- Sanpete Water Conservancy District
- Natural Resources Conservation Service
- Utah Division of Natural Resources
- Sanpete Conservation District
- Utah Division of Water Resources
- Sanpete County Commission
- Utah Division of Water Rights
- San Pitch Watershed Stewardship Group
- Gunnison City
- Centerfield City
- Mayfield Town
- Utah Department of Agriculture and Food
- Gunnison Irrigation Company
- Mayfield Irrigation Company
- U.S. House of Rep. Jason Chaffetz
- U.S. Senator Orrin Hatch
- U.S. Senator Bob Bennett
- Utah State Representative *Kay L. McIff*
- Utah State Senator *D. Peterson, R. Okerlund*
- Utah Water Quality Board
- Utah Division of Water Quality
- USDA Forest Service
- Jones & DeMille Engineering
- Kleinfelder – Geotechnical Engineering
- Dr. John Keith –Economic Analysis



# PHASE I

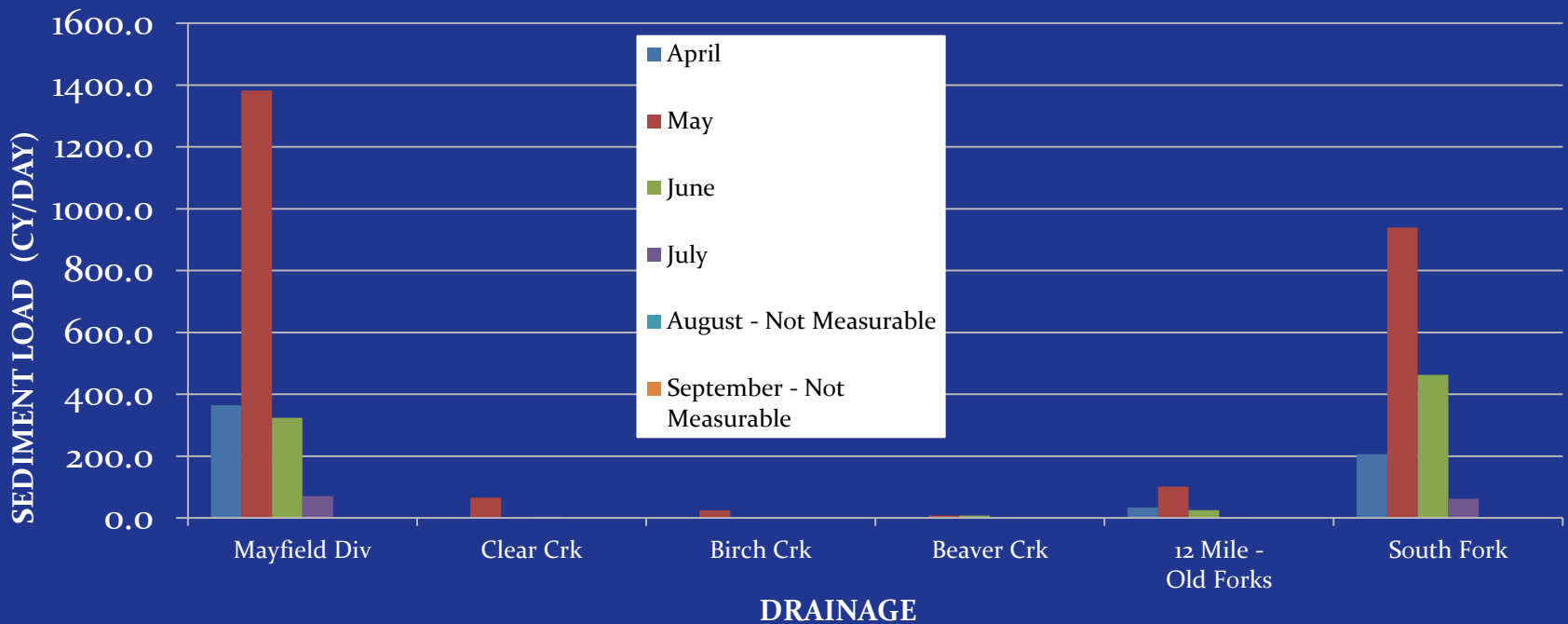
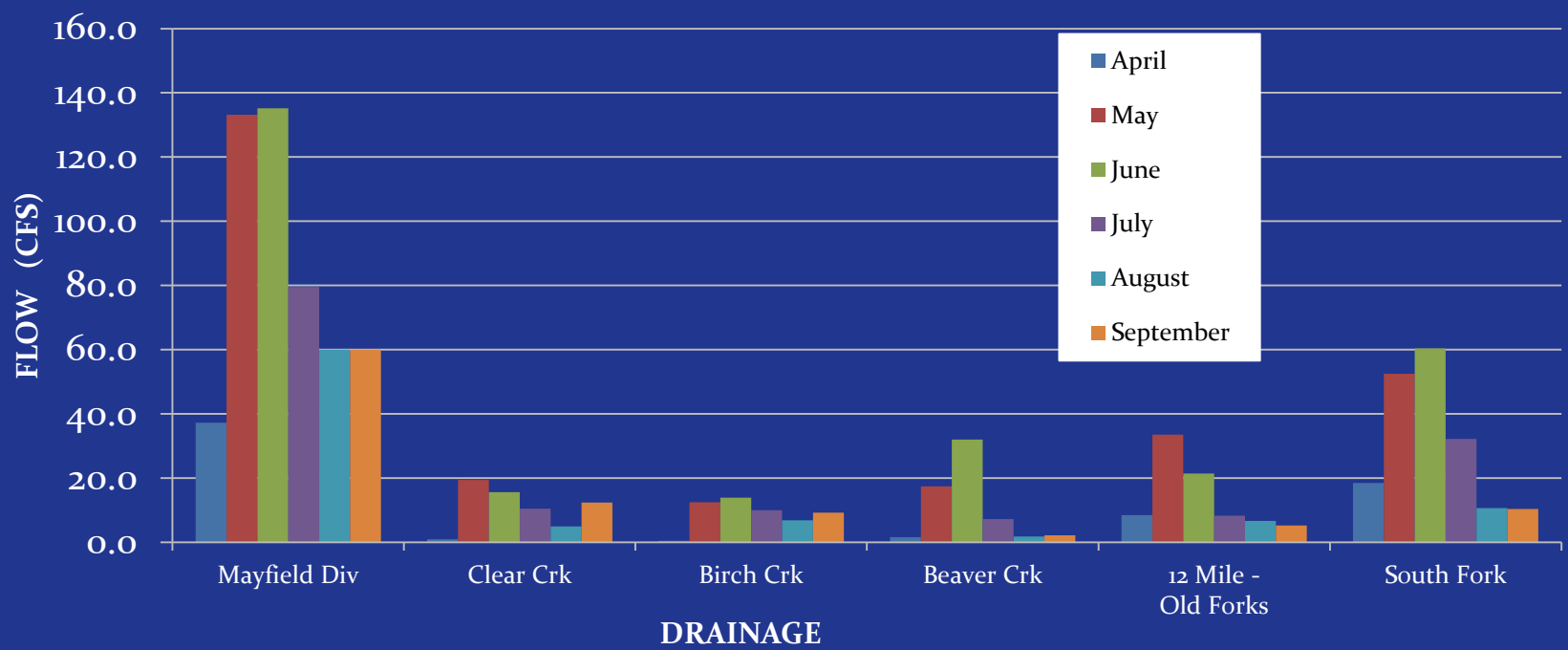
## TASK 2. DATA GATHERING

- Water Quality Data – Pre & Post 1983

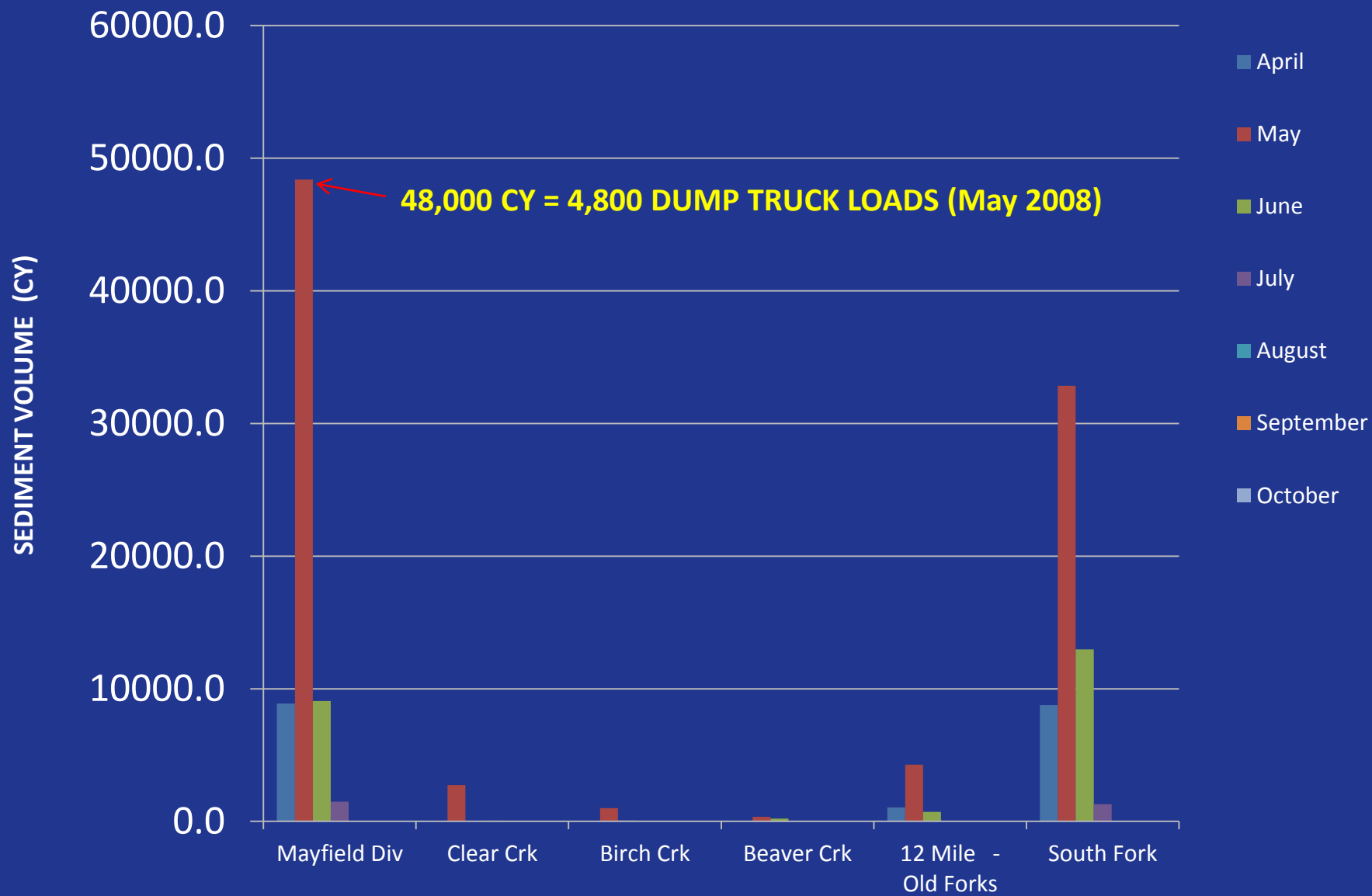


- According to the Mayfield and Gunnison Irrigation Companies 2008 was a good year in terms of suspended sediment (this is likely due to the inactivity of the Cooley Creek Slide)

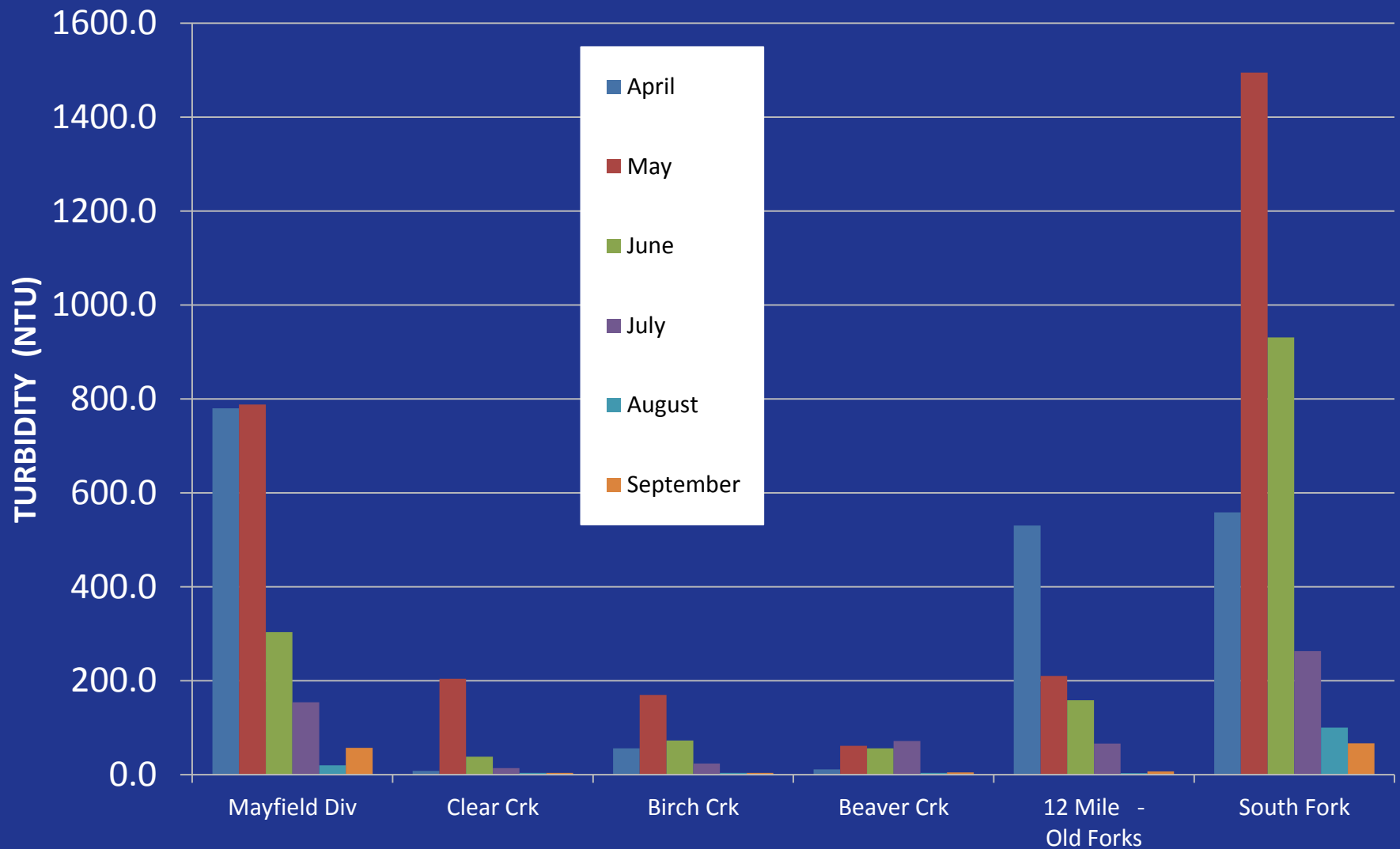






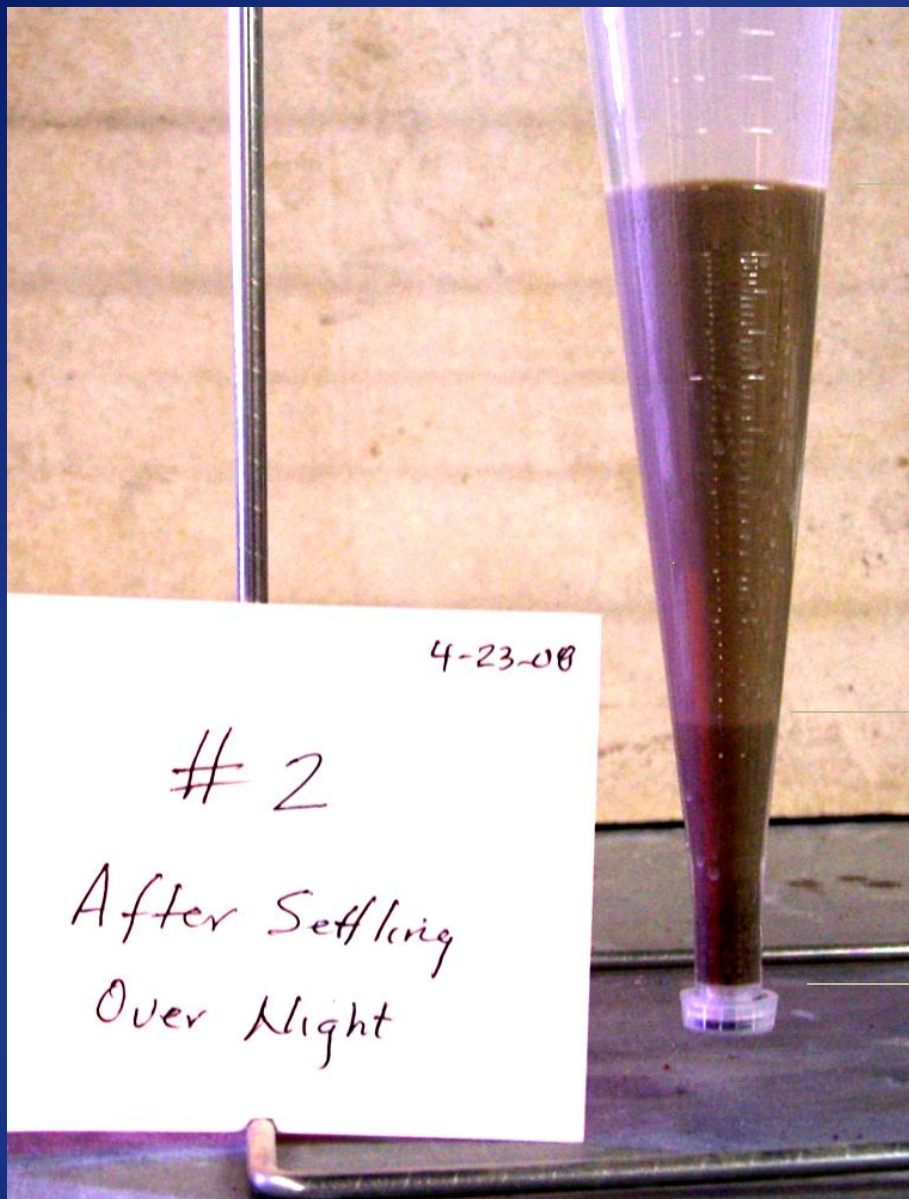






Turbidity : Measures cloudiness of water  
Impacts cold water species like fish





**DISPERSED  
CLAY**

**SETTLED SEDIMENT  
(SAND, SILT, CLAY)**



# PHASE I

## TASK 3. ECONOMIC IMPACT ANALYSIS

- Based on Alfalfa Crop Production – 2008 RFV
- Crop Fields Used for Comparison - Based on Water Source
  - 100% Twelve Mile Creek Water
  - Partial Twelve Mile Creek Water
  - 0% Twelve Mile Creek Water

	Mayfield (3,000 acres)	Gunnison (13,000 acres)
1st Crop Loss	\$ 76,000	\$ 207,000
2nd Crop Loss	\$ 110,000	\$ 360,000
Additional Maintenance	\$ 16,000	\$ 90,000
<b>TOTAL</b>	<b>\$ 202,000</b>	<b>\$ 657,000</b>

- Estimated Total Annual losses – **\$859,000**
- Present value of losses over the 20 year life (with 5% depreciation) of a proposed project that would eliminate impacts to the RFV value totals approximately - **\$10,000,000**



# PHASE I - CONCLUSIONS

- Suspended sediment loads in Twelvemile Creek exceed previous loads recorded from 1975 to 1980 and likely are the highest since mid 1800's
- Over 50% of the water from 12 Mile come from South Fork Drainage
- In 2008 very little slide activity occurred in Twelvemile Canyon
  - Most of the suspended sediment within Twelvemile Creek is likely attributed to the erosion of stream banks by meandering stream channels through old slide deposits
  - Even though the slide areas were inactive the suspended sediment concentrations were over four times greater than sediment concentrations recorded in 1975 to 1980.
- The hydrogeologic study showed that totally replacing Twelvemile Creek water with groundwater was not feasible
- **Suspended Sediment Impacts**
  - Inhibits cold water species – Inhibits fishery along Twelvemile that was previously established pre 1983
  - Suppresses Beneficial Use
  - Burdens local communities
  - Causes economic losses to the Mayfield and Gunnison Irrigation Companies which are estimated to be approximately **\$859,000 annually**.
    - Present value of losses over the 20 year life (with 5% depreciation) of a proposed project, that would eliminate impacts to the RFV value, totals approximately - **\$10,000,000**



# PHASE II – Data Evaluation & Alternative Analysis

- **Data Evaluation**

- Core Drilling on the Slides
- Geotechnical Study of Slide (by Kleinfelder)
- Streambank Stabilization Strategies
- Hydrologic Evaluation of Slide Area
- Investigation of Sediment Removal Strategies
- Discussion and Site Investigations with USFS



# PHASE II – Data Evaluation & Alternative Analysis

## ● Watershed Alternatives Evaluated

- No Action
- Constructing Large Buttresses to Prevent Slide Movement
- Piping all Surface Water Through South Fork
- Removing Surface Water Upstream of Slide Area to Lower Groundwater Levels in Slide
- Stream bank Stabilization – Willow Planting, Riprap, Geosynthetics, Etc.

## ● Downstream Alternatives Evaluated

- Constructing or Enlarging Sedimentation Structures
- Constructing In-Stream Diversion Sluicing Structures
- Adding Chemicals to Increase Sedimentation
- Supplementing Twelvemile with Groundwater



## PHASE II – Key Conclusions

- Best solution is prevention -keeping soils within the watershed
- High groundwater levels caused by influent water from outside the slide area
- For removing sediment from the creek - Increasing hydraulic capacity and detention volumes ranks highest among the alternatives when comparing effectiveness, sustainability, and feasibility



# PHASE II - Effectiveness of Sedimentation Basins

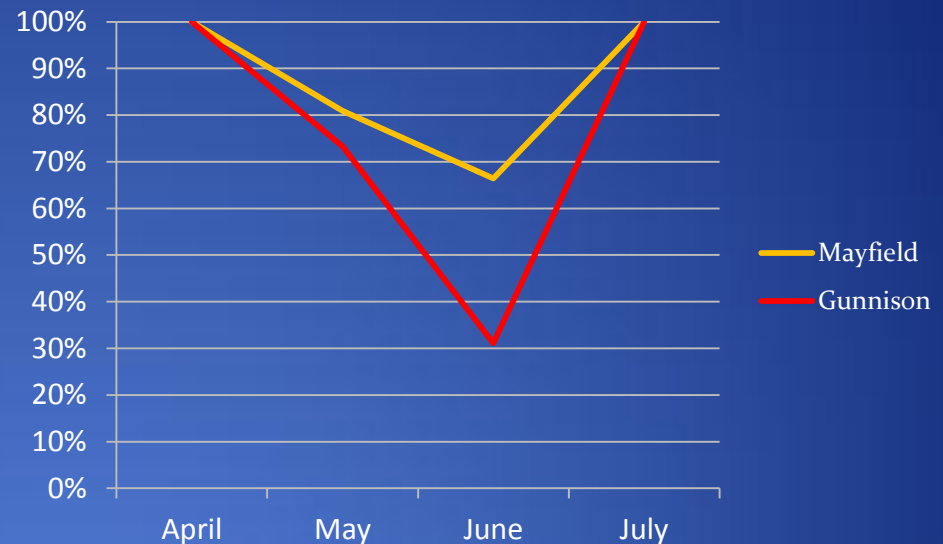
- Existing Sediment Removal Devices

- Mayfield Irrigation Company

- Canal & desilting structure removed an average of **82%** of total suspended sediment load

- Gunnison Irrigation Company

- Canal & settling pond removed an average of **73%** of the total suspended sediment load

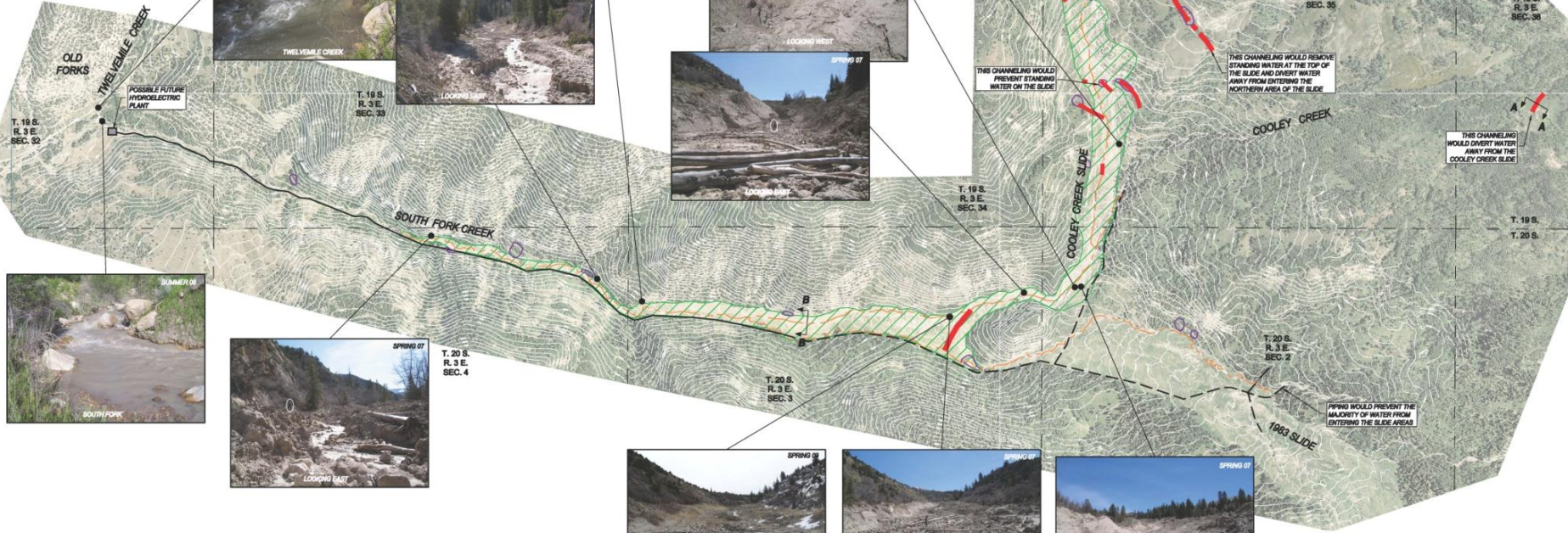
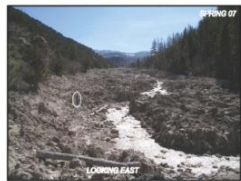




# SELECTED ALTERNATIVE - WATERSHED

- **Objective** – Stabilize Sediments to Remain in Watershed
  - Stabilize Cooley Creek Slide Mass -With no new slide activity sediment is manageable
    - Upstream diversions of surface water to lower groundwater table
    - Channeling or Piping to remove standing or influent surface water
  - Stabilize Stream Banks
    - Seeding & Willow Planting
    - Channeling to reduce length of creeks through slide deposits
- **Challenges** –
  - USFS Approval (Area is Roadless)
  - ESTIMATED COST - \$250,000
- **Accomplishments**–
  - USFS has determined an EA is required
  - EA is nearing completion
  - Test wells will be used to measure effectiveness of mitigation measures





**PREPARED BY:**  
**Jones & DeMille Engineering, Inc.**  
 1825 South 100 West - Richfield, Utah 84701  
 Phone (435) 885-8285 - Fax (435) 885-8286  
 www.jonesandmille.com

**PROJECT NUMBER:** 0001-118 **FILE NAME:** HSLP/PROJ/0001-118/WORKBOOK/0001-118.D  
**SURVEYED BY:** - **DRAWN BY:** BL/LB **LAST DATE:** 07/08

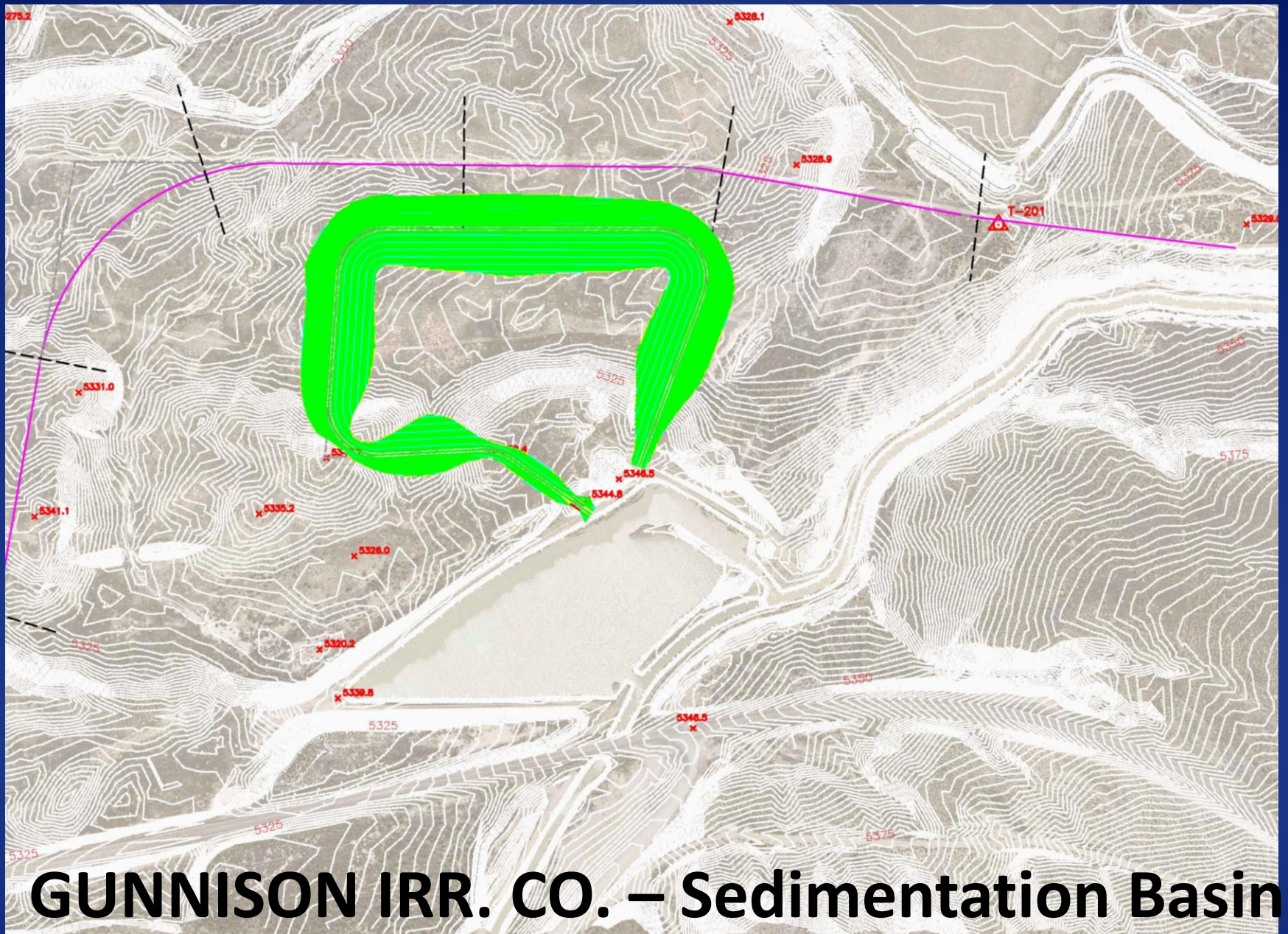
**Twelvemile Canyon**  
**Preliminary Remediation Strategy**  
 SANPETE COUNTY  
 1" = 500'



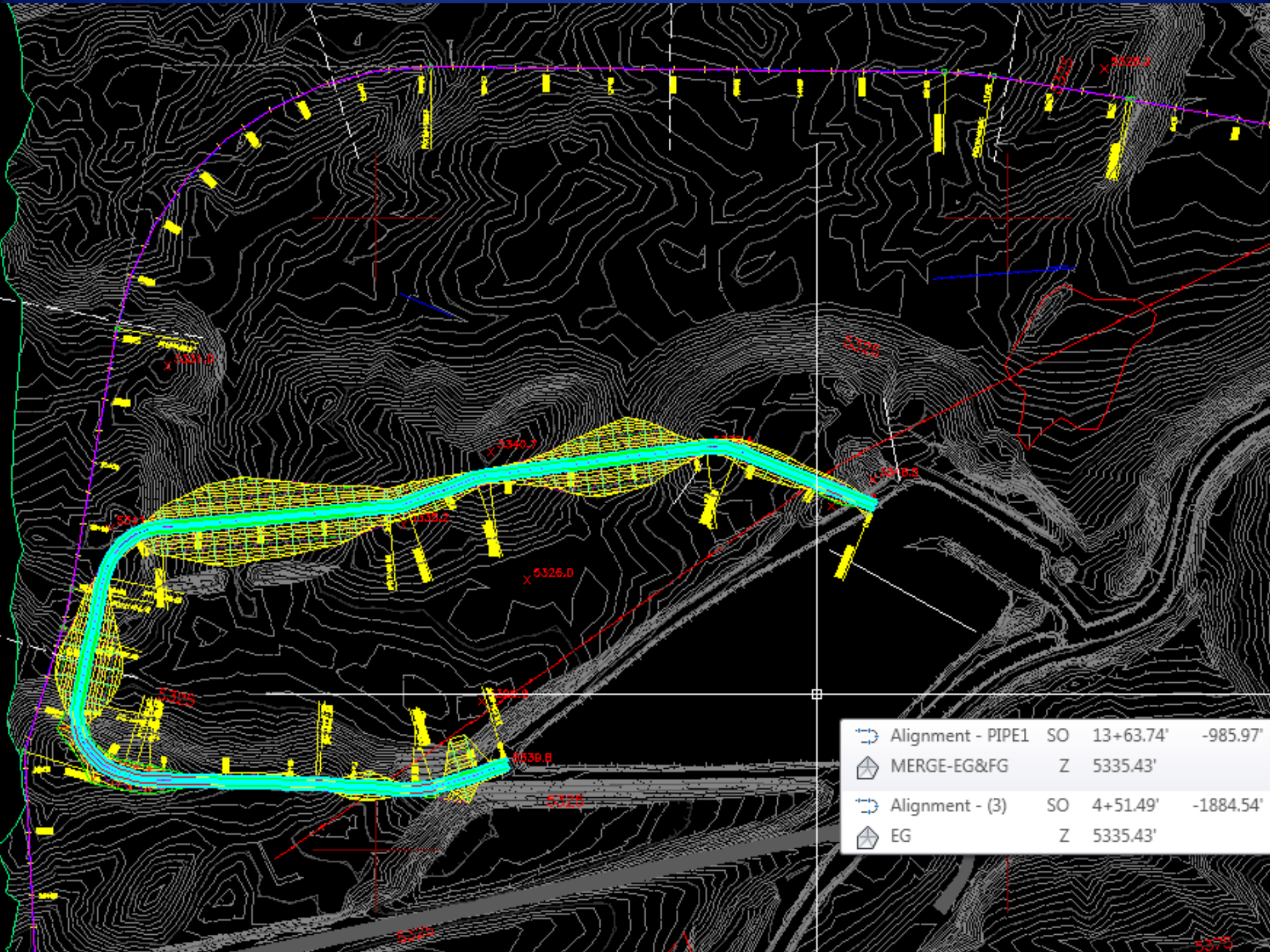
# SELECTED ALTERNATIVE - INSTREAM

- Objective – Increase Ability to Remove Sediment From the Creek and Prevent it From Returning
  - Construct Sedimentation Basin
    - Increase Hydraulic Detention Time to Allow Sediments to Settle Out More Effectively
    - Dual Basins Allow One to be Off Line and Dry Out – Dry mud is much less expensive and time consuming to remove.
    - Sediment is removed to locations that will not flow back into Twelvemile Creek
- Challenges –
  - Project was bid - project cost too high
  - Project modification
  - Utah Dam Safety Approval
  - ESTIMATED COST - \$600,000
- Accomplishments –
  - Final design nearing completion
  - Ongoing Discussions with Dam Safety
  - Material tests indicate soils in full sedimentation basin could be used in proposed dam
  - Centerfield City waterline relocated for future sed. basin placement
  - Property purchased by Gunnison Irr. Co. for future sedimentation basin









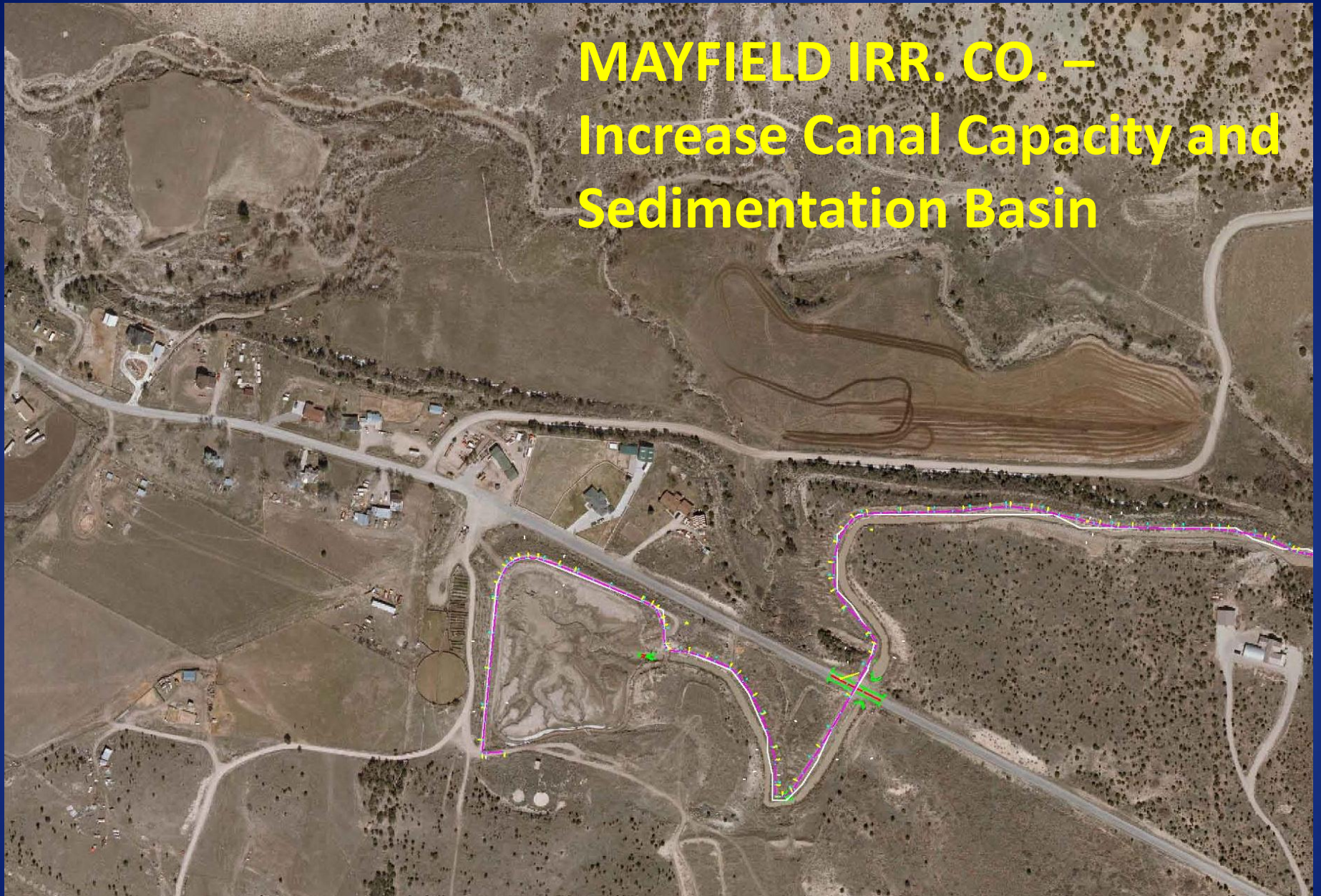


# SELECTED ALTERNATIVE - INSTREAM

- **Objective** – Increase Ability to Remove Sediment From the Creek and Prevent it From Returning
  - Increase Canal and Small Pond Embankment Height
    - Increase Hydraulic Detention Time to Allow Sediments to Settle Out More Effectively
    - Sediment Deposited in the Canal is much Easier to Remove Before it Enters the Small Pond
  - Construct Sediment Retention Basin
    - Prevent Sediment Washed out of Pond from Returning to Twelvemile Creek
- **Challenges** –
  - Utah Dam Safety approval
  - ESTIMATED COST - \$180,000
- **Accomplishments** –
  - Final design nearing completion
  - Private property owner has signed a letter stating he is in favor of the sedimentation basin on his property
  - Material tests indicate some soils excavated out of the canal could be used in the raising of the canal and pond embankment



**MAYFIELD IRR. CO. –  
Increase Canal Capacity and  
Sedimentation Basin**





# WATER QUALITY BENEFIT

- Mitigation to keep sediment in the watershed improves the water quality of the entire length of Twelvemile Creek and downstream water bodies
- Removing instream sediment before use, allows the water to be put to beneficial use for which it was intended
- Using sediment laden Twelvemile Creek water prevents the sediment from entering downstream water bodies
- Sedimentation basins (Mayfield) to capture sediment from sluicing water would prevent much of it from returning to Twelvemile Creek



# EXPLORED FUNDING SOURCES

- **Irrigation Companies**
  - Gunnison Irrigation Company
    - \$15,000 Relocate Waterline
- **Sanpete Water Conservancy District**
  - Has added project to their list of projects to fund (potentially \$100,000).
  - They are next in line after the Narrows Project, which may be a few years out.
- **Sanpete Soil Conservation District – San Pitch Watershed Stewardship Group**
  - Relocating Waterline for Future Sediment Pond Area - \$23,000
  - Amendment to 319 – potentially \$109,600 adjusted to \$68,000
- **Utah Department of Agriculture** – Had a verbal commitment of approx. \$50,000 but fell through due to economy
- **Utah Division of Water Quality** – funded \$150,000 to begin studying the issue
  - Utah Water Quality Board – Grant of \$727,400 for Construction
- **Utah State Legislature** funded \$150,000 as part of the study, no further funds have been able to be allocated
- **Other State and Federal Leaders and Offices** have been contacted but no funding has been able to be accessed
- **Utah Community Impact Board** funded \$150,000 as part of the study, quantifying the impact to the local communities is difficult and would be required

ITEMS IN RED ARE DOLLARS THAT HAVE BEEN SPENT OR MONEY THAT HAS BEEN ACQUIRED